

What is claimed is:

1. A nozzle for providing nitrous oxide to an internal combustion engine having:
 - a central fuel injector passage terminating at a first outlet end for passing fuel from a fuel injector therethrough;
 - an inner annular passage arranged circumferentially around the central fuel injector passage, and terminating at a second outlet end; and
 - an outer annular passage arranged circumferentially around the inner annular passage, and terminating at a third outlet end;
 - wherein one or both of the inner and outer annular passages is adapted to pass nitrous oxide therethrough.
2. The nozzle of claim 1, wherein the nozzle is adapted to be positioned between a fuel injector and an engine without substantial modification to the engine.
3. The nozzle of claim 1, wherein the central fuel injector passage is tapered to have a larger inside diameter at the first outlet end.
4. The nozzle of claim 1, wherein the central fuel injector passage has an inside diameter of between about 0.080 and about 0.150 inches.
5. The nozzle of claim 1, wherein the central fuel injector passage has an inside diameter of about 0.104 inches.
6. The nozzle of claim 1, wherein the central fuel injector allows at least about 80% of fuel sprayed from the fuel injector to pass unimpeded therethrough.
7. The nozzle of claim 1, wherein the second outlet end is staggered back from the first outlet end.
8. The nozzle of claim 7, wherein the second outlet end is staggered back from the first outlet end by between about 0.010 inches and about 0.100 inches.

9. The nozzle of claim 7, wherein the second outlet end is staggered back from the first outlet end by about 0.050 inches.
10. The nozzle of claim 1, wherein the third outlet end is staggered back from the second outlet end.
11. The nozzle of claim 10, wherein the third outlet end is staggered back from the second outlet end by between about 0.010 inches and about 0.100 inches.
12. The nozzle of claim 10, wherein the third outlet end is staggered back from the second outlet end by about 0.050 inches.
13. The nozzle of claim 1, wherein at least two of the first outlet end, the second outlet end and the third outlet end are staggered relative to one another to allow the nozzle to be fitted into at least two different engines.
14. The nozzle of claim 1, wherein the inner annular passage has a width of between about 0.008 and about 0.030 inches, as measured at the second outlet end.
15. The nozzle of claim 1, wherein the inner annular passage has a width of between about 0.013 and about 0.014 inches, as measured at the second outlet end.
16. The nozzle of claim 1, wherein the outer annular passage has a width of between about 0.010 and about 0.045 inches, as measured at the third outlet end.
17. The nozzle of claim 1, wherein the outer annular passage has a width of between about 0.020 and about 0.021 inches, as measured at the third outlet end.
18. The nozzle of claim 1, wherein the inner annular passage is adapted to pass fuel therethrough, and the outer annular passage is adapted to pass nitrous oxide therethrough.
19. The nozzle of claim 1, wherein the inner annular passage and the outer annular passage are adapted to pass nitrous oxide therethrough.

20. The nozzle of claim 1, wherein the nozzle is adapted to fit between a fuel injector and an engine without raising the fuel injector more than about 1.25 inches relative to a fuel injector receptacle.
21. The nozzle of claim 1, wherein the nozzle is adapted to fit between a fuel injector and an engine without raising the fuel injector more than about 0.75 inches relative to a fuel injector receptacle.
22. The nozzle of claim 1, wherein the second outlet end comprises second outlet castellations.
23. The nozzle of claim 22, wherein the second outlet castellations have a width of between about 0.020 and about 0.100 inches and a depth of between about 0.010 and about 0.040 inches.
24. The nozzle of claim 22, wherein the second outlet castellations have a width of about 0.060 inches and a depth of about 0.024 inches.
25. The nozzle of claim 1, wherein the third outlet end comprises third outlet castellations.
26. The nozzle of claim 25, wherein the third outlet castellations have a width of between about 0.050 and about 0.150 inches and a depth of between about 0.010 and about 0.060 inches.
27. The nozzle of claim 25, wherein the third outlet castellations have a width of about 0.094 inches and a depth of about 0.030 inches.
28. The nozzle of claim 1, wherein the second outlet end comprises second outlet castellations and the third outlet end comprises third outlet castellations, the second outlet castellations and third outlet castellations being indexed relative to one another.

29. The nozzle of claim 1, wherein the second outlet end comprises second outlet fingers extending from the second outlet end to an exterior wall of the central fuel injector passage.
30. The nozzle of claim 1, wherein the third outlet end comprises third outlet fingers extending from the third outlet end to an exterior wall of the inner annular passage.
31. The nozzle of claim 1, further comprising an inner annular passage inlet oriented relative to the inner annular passage to promote beneficial flow in the inner annular passage.
32. The nozzle of claim 31, wherein the inner annular passage inlet is oriented tangential to the inner annular passage and angled towards the second outlet end.
33. The nozzle of claim 1, further comprising an outer annular passage inlet oriented relative to the outer annular passage to promote beneficial flow in the outer annular passage.
34. The nozzle of claim 33, wherein the outer annular passage inlet is oriented tangential to the outer annular passage and angled towards the third outlet end.
35. A nozzle for providing fluids to an internal combustion engine comprising:
 - an interior cup having a fuel injector receptacle at a first inlet end and a fuel injector passage terminating at a first outlet end for passing fuel from a fuel injector therethrough;
 - a middle cup adapted to fit circumferentially around at least a portion of the interior cup to form an inner annular passage therebetween, the inner annular passage terminating at a second outlet end; and
 - an exterior cup adapted to fit circumferentially around at least a portion of the middle cup to form an outer annular passage therebetween, the outer

annular passage terminating at a third outlet end, the exterior cup being further adapted to fit within a fuel injector receptacle in an engine;

wherein one or both of the middle cup and the exterior cup is adapted to pass an additional fluid therethrough; and

wherein the nozzle is adapted to fit between a fuel injector and an engine without substantial modification to the engine.

36. The nozzle of claim 35 wherein the additional fluid is nitrous oxide.
37. The nozzle of claim 35, wherein the additional fluid is a combustion reactant.
38. The nozzle of claim 35, wherein the interior cup, middle cup, and exterior cup are made from injection molded plastic.
39. The nozzle of claim 38, wherein the interior cup, middle cup, and exterior cup are ultrasonically welded together.
40. The nozzle of claim 38, wherein the interior cup, middle cup, and exterior cup are made from one or more metals.
41. The nozzle of claim 40, wherein the interior cup, middle cup, and exterior cup are welded together.
42. The nozzle of claim 40, wherein one or more of the interior cup, middle cup, and exterior cup is fabricated from an extrusion.
43. The nozzle of claim 42, wherein the extrusion is shaped to provide a net-shape machining advantage to the production of the one or more of the interior cup, middle cup, and exterior cup fabricated from the extrusion
44. The nozzle of claim 42, wherein the extrusion is an earlobed extrusion.
45. A nozzle for providing nitrous oxide to an internal combustion engine comprising:
a central fuel injector passage terminating at a first outlet end for passing fuel from a fuel injector therethrough;

an inner annular passage arranged circumferentially around the central fuel injector passage and terminating at a second outlet end, the second outlet end comprising a first set of castellations and fingers that extend from the second outlet end and terminating adjacent an outer wall of the central fuel injector passage; and

an outer annular passage arranged circumferentially around the inner annular passage, and terminating at a third outlet end, the third outlet end comprising a second set of castellations and fingers that extend from the third outlet end and terminating adjacent an outer wall of the central fuel injector passage.

46. The nozzle of claim 45, wherein one or both of the inner and outer annular passages is adapted to pass nitrous oxide therethrough.
47. The nozzle of claim 45, wherein the nozzle is adapted to fit between a fuel injector and an engine without substantial modification to the engine.
48. The nozzle of claim 45, wherein at least one of the first set of castellations and the second set of castellations is adapted to encourage tumble flow in fuel and nitrous oxide exiting the nozzle.
49. The nozzle of claim 45, wherein at least one of the first set of castellations and the second set of castellations is substantially perpendicular with the cylindrical axis of the nozzle.
50. The nozzle of claim 45, wherein at least one of the first set of castellations and the second set of castellations is adapted to encourage swirl flow in fuel and nitrous oxide exiting the nozzle.
51. The nozzle of claim 45, wherein at least one of the first set of castellations and the second set of castellations is angled with respect to the cylindrical axis of the nozzle.

52. The nozzle of claim 45, wherein at least one of the first set of castellations and the second set of castellations is adapted to reduce fuel choke-off.

53. The nozzle of claim 45, wherein the first set of castellations and the second set of castellations are indexed relative to one another.

54. A method for providing fluids to an internal combustion engine comprising:

- providing a central fuel injection passage terminating at a first outlet end;

- providing fuel from a fuel injector to an engine through the central fuel injection passage;

- providing an inner annular passage, the inner annular passage being arranged circumferentially around the central fuel injector passage, and terminating at a second outlet end;

- providing additional fuel or nitrous oxide to the engine through the inner annual passage;

- providing an outer annular passage, the outer annual passage being arranged circumferentially around the inner annular passage and terminating at a third outlet end; and

- providing additional fuel or nitrous oxide to the engine through the outer annual passage.

55. The method of claim 54, wherein the step of providing additional fuel or nitrous oxide to the engine through the inner annual passage further comprises passing the additional fuel or nitrous oxide through a first set of castellations at the second outlet end.

56. The method of claim 54, wherein the step of providing additional fuel or nitrous oxide to the engine through the outer annual passage further comprises passing the additional fuel or nitrous oxide through a second set of castellations at the third outlet end.

57. A nitrous oxide kit for internal combustion engines that provides nitrous oxide through the engine's original fuel injector receptacles comprising:
- a nozzle adapted to pass fuel and nitrous oxide therethrough;
 - wherein the nozzle is adapted to be installed between an engine's fuel injectors and the engine's fuel injector receptacles; and
 - wherein the nozzle may be installed between the fuel injectors and the fuel injector receptacles without substantial modification to the engine.
58. A method of installing a nitrous oxide system in an engine comprising:
- removing the fuel injector from each fuel injector receptacle;
 - installing a nozzle adapted to pass fuel and nitrous oxide therethrough in each fuel injector receptacle; and
 - installing the fuel injectors into the nozzles.
59. The method of claim 58, wherein each nozzle is adapted to pass two separate flows of nitrous oxide therethrough.
60. The method of claim 58, wherein each nozzle is adapted to pass two separate flows of fuel and one flow of nitrous oxide therethrough.
61. The method of claim 58, further comprising:
- installing a nitrous oxide distribution block in the proximity of the engine;
 - and
 - connecting each nozzle to the nitrous oxide distribution block.
62. The method of claim 58, further comprising:
- installing a two channel distribution block in the proximity of the engine;
 - and
 - connecting each nozzle to each of two channels of the two channel distribution block.

63. The method of claim 62, wherein both of the two channels convey nitrous oxide.

64. The method of claim 62, wherein one of the two channels conveys nitrous oxide and the other of the two channels conveys additional fuel.

65. A method for manufacturing a nitrous oxide nozzle comprising:

inserting an interior cup having a central passage therethrough into a middle cup such that an inner annular passage is formed between the interior cup and the middle cup;

inserting the middle cup into an exterior cup such that an outer annular passage is formed between the middle cup and the exterior cup;

joining the interior cup to at least one of the middle cup and the exterior cup;

joining the middle cup to at least one of the interior cup and the exterior cup; and

joining the exterior cup to at least one of the interior cup and the middle cup.

66. The method of claim 65, wherein the joining steps comprise at least one of friction fitting and swaging.

67. The method of claim 65, wherein the joining steps comprise ultrasonically welding.

68. The method of claim 65, wherein the joining steps comprise one of welding and brazing.

69. The method of claim 65, wherein the joining steps comprise bonding.

70. A nozzle for providing one or more combustion reactants to an internal combustion engine having:

a central fuel injector passage terminating at a first outlet end for passing fuel from a fuel injector therethrough;

an inner annular passage arranged circumferentially around the central fuel injector passage, and terminating at a second outlet end; and

an outer annular passage arranged circumferentially around the inner annular passage, and terminating at a third outlet end;

wherein one or both of the inner and outer annular passages is adapted to pass nitrous oxide therethrough.

71. The nozzle of claim 70, wherein the nozzle is adapted to be positioned between a fuel injector and an engine without substantial modification to the engine.
72. The nozzle of claim 70, wherein the combustion reactants comprise propane.
73. The nozzle of claim 70, wherein the combustion reactants comprise natural gas.
74. The nozzle of claim 70, wherein the combustion reactants comprise alcohol.
75. The nozzle of claim 70, wherein the combustion reactants comprise an alcohol blend.
76. The nozzle of claim 70, wherein the combustion reactants comprise gasoline.
77. The nozzle of claim 70, wherein the combustion reactants comprise nitrous oxide.